

REMARKS

Please reconsider this application in view of the above amendments and the following remarks.

- Claims 1-3, 7, 8, 10-16, 20, 24, and 26 are pending.
- Claims 1-3, 7, 8, 10-16, 20, 24 are rejected.
- Claims 4-6, 9, 17-19, 21-23, and 25 are canceled.

Basis of the Amendments

Amended claim 1 is based on original claims 1 and 6, and amended claim 7 is based on original claims 7, 9, 17 and 18. Newly added claims 26 to 28 are based on page 44, line 25, to page 45, line 8, of the specification. The other amended claims are based on their corresponding original claims, respectively. Furthermore, the amendment in the drawings and specification corrects minor informalities. Thus, all amendments are based on the original claims and specification and do not include any new matter.

Objections in the drawings

The Examiner pointed out that the microphotographs of FIG. 1 and 6 to 10 are too dark to distinguish individual particles. The applicant respectfully has amended the original drawings. The amended microphotographs are based on the original image data, but with the image density and contrast optimized. Thus, the amendment does not include any new matter.

Furthermore, the Examiner pointed out that the original drawings and specification include informalities regarding reference numerals. The applicant has amended FIG. 4 and the specification to correct these informalities.

The reference numerals 65a and 65b are originally on FIG. 4. The description on page 57, line 18 has been amended so that both FIG. 3 and FIG. 4 are referred to in the description of the fourth embodiment. The reference numerals 50 and 60 on FIG. 4 are

deleted. The reference numerals 50 and 60 are originally on FIG. 3. As for the reference numerals 5, 71R, 71G and 71B, the above-described amendment to page 57 also remedies the inconsistency that those reference numerals are not part of FIG. 4, but of FIG. 3.

In view of the foregoing, the present application now complies with 37 CFR 1.84.

Claim Rejections under 35 USC § 112

In the Office Action, claims 1, 2, 17 and 18 are rejected as being indefinite, since these claims refer to a silicate phosphor while reciting a mixture of silicon system material and a metallic element.

The applicant has amended claim 1, so that claim 1 now recites a silicate phosphor containing a silicon element and a metallic element. Since the silicate phosphor of the invention is explained in the present description in detail, a person skilled in the art can understand the silicate phosphor of the invention and can clearly understand that the silicate phosphor constitutes a silicon element and metallic element.

Prior art rejections

In the Office Action, claims 7 to 9, 11 to 17, 19 and 20 are rejected as being anticipated by US 3,541,019.

This reference discloses a method of preparing a phosphor comprising the steps of mixing a zinc and manganese solution with silica hydrogel, precipitating metal salts on the silica, and calcining the material at a temperature of approximately 1000°C. However, with respect to the properties of the prepared phosphor, this reference only discloses the luminescence intensity thereof and does not disclose particle size and coefficient of variation of inter-particle composition distribution of constituting elements in the phosphor particles, as amended claim 1 recites. Furthermore, this reference does not disclose the calcining step of amended claim 7, i.e. the first calcining of the precursor to prevent the precursor from sintering, and a second calcining comprising calcining the product ob-

tained in the first calcining. This claimed calcining step enables one to obtain the phosphor of claim 1 having low coefficient of variation of inter-particle composition distribution of constituting elements in the particles despite its small particle size. Therefore, the phosphor of amended claim 1 is distinct over the phosphor disclosed in this reference, and this reference does not disclose the phosphor of amended claim 1. The applicant respectfully submits the collateral evidence thereof by the Declaration filed along with this response.

In the Office Action, claims 7 to 11, 14 to 16, 19 and 20 are rejected as being anticipated by US 6,576,156.

This reference discloses that a slurry of colloidal silica is mixed with metal oxide such as zinc oxide and then calcined. Aerosil is preferably used as a silica precursor. Aerosil is fumed silica, which is not wet silica and has a surface area of 150 to 350 m²/g. Furthermore, the calcining temperature of 1100°C, in the case of manganese doping, is disclosed.

Thus, this reference does not disclose or suggest using wet silica and calcining twice, as claim 7 recites. Furthermore, since the method of amended claim 7 is not disclosed, one can conclude that the silicate phosphor of claim 1 is not disclosed either, as described above. The applicant respectfully submits the collateral evidence thereof by the Declaration filed along with this response.

In the Office Action claims 1 to 6, 20, 24 and 25 are rejected as being unpatentable over WO00/71636.

This reference discloses that ammonia water is added to TEOS so that hydrated silica is precipitated, the precipitate is added to zinc and manganese solution, ammonium oxalate solution is added, and the pH of the solution is adjusted with diethyl amine, so that a desired precipitate is obtained. The phosphor is obtained by calcining the precipitate at a temperature of 1050°C and further re-calcining it at a temperature of 900°C under a reducing atmosphere. The phosphor obtained is uniform, has a particle size of not more than 1 μm, and the particles are spherical and not fused with each other (FIG. 1).

However, this reference does not disclose using wet silica as recited in amended claim 7. Moreover, since the method of amended claim 7 is not disclosed, one can conclude that the silicate phosphor of claim 1 is not disclosed either, as described above. The applicant respectfully submits the collateral evidence thereof by the Declaration filed along with this response.

In the Office Action, claims 1, 20 and 24 are rejected as being unpatentable over US 5,985,176, US 6,039,894 or US 6,180,029.

US 5,985,176 discloses that TEOS is added to zinc and manganese solution and that a product with a fine particle size and with uniform distribution is obtained (Table IX). However, this reference does not disclose or suggest using wet silica.

US 6,039,894 discloses that the monodisperse precursor is suspended in fluidizing gas, exposed to reactive gas and heated. This reference does not disclose or suggest a silicate phosphor. Furthermore, the obtained phosphor has a particle size of several micrometers. Thus, the silicate phosphor of claim 1 is distinct from the phosphor disclosed in this reference.

US 6,180,029 discloses a phosphor having a particle size of 0.3 to 5 μm , with superior particle size distribution. However, this reference only discloses an ultrasonic dispersing method and does not disclose or suggest the method of amended claim 7. Furthermore, this reference does not disclose any silicate phosphor in its embodiment.

In view of the foregoing, one can conclude that the above three references do not disclose or suggest the method of amended claim 7. Furthermore, since the method of amended claim 7 is not disclosed, the silicate phosphor of claim 1 is not disclosed either, as described above.

In the Office Action, claim 7 to 9, 11, 14 to 16, 19 and 20 are rejected as being unpatentable over US 5,518, 655.

This reference discloses a method of mixing zinc oxide and silica and subsequently calcining. The method of amended claim 7 is distinct from the method disclosed

in this reference. Thus, the method of amended claim 7 and the silicate phosphor of claim 1 are not obvious from this reference.

In the Office Action, claims 7 to 11, 14 to 16, 19 and 20 are rejected as being unpatentable over US 5,611, 961.

This reference only discloses using fumed silica and does not disclose or suggest using wet silica. Thus, the method of amended claim 7 and the silicate phosphor of claim 1 are not obvious from this reference.

Amended claims 2, 3, 8, 10 to 16, 20, 24, 26 to 28 are either directly or indirectly dependent on claim 1 or 7, respectively, and are patentable over the cited reference in view of their dependence on claims 1 and 7.

In view of the foregoing, the present application is patentable over the cited reference under 35 US §§ 102 and 103, and the present invention now stands ready for allowance.

Since all claims are allowable, please issue a Notice of Allowability for these claims. If I can be of any help, please call me.

Respectfully submitted,

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AMENDMENTS TO THE DRAWINGS

Replacement drawing sheets, so labeled, are attached to this response.